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John M. Kulp

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JOHN M. KULP

Appeal 2008-3578
Application 10/675,419
Technology Center 1700

Decided: July 29, 2008

Before CHARLES F. WARREN, TERRY J. OWENS, and
LINDA M. GAUDETTE, *Administrative Patent Judges*.

OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

The Appellant appeals from a rejection of claims 1-35, which are all of the pending claims.

THE INVENTION

The Appellant claims a method for developing a resist film. Claim 1 is illustrative:

1. A method for developing a resist film formed on a substrate, the method comprising the steps of:
applying a surfactant-containing liquid onto the resist film;
displacing the surfactant-containing liquid film with a developing solution of selected concentration; and
developing the resist film using the developing solution.

THE REFERENCES

Ogata	US 5,845,170	Dec. 1, 1998
Phan	US 6,136,514	Oct. 24, 2000
Maemori	US 2002/0058202 A1	May 16, 2002
Takizawa	US 6,472,127 B1	Oct. 29, 2002
Hayasaki	US 2004/0029026 A1	Feb. 12, 2004 (filed Jan. 27, 2003)

THE REJECTIONS

The claims stand rejected as follows: claims 1, 3, 11, 14, 17 and 19 under 35 U.S.C. § 102(e) over Takizawa; claims 2, 4, 5, 9, 10, 18, 20, 21, 23-25, 28, 31, 34 and 35 under 35 U.S.C. § 103 over Takizawa in view of Phan; claims 6-8 under 35 U.S.C. § 103 over Takizawa in view of Ogata; claims 12, 13, 15 and 16 under 35 U.S.C. § 103 over Takizawa in view of Hayasaki; claim 22 under 35 U.S.C. § 103 over Takizawa in view of Phan and Maemori; claims 26 and 27 under 35 U.S.C. § 103 over Takizawa in view of Phan and Ogata; and claims 29, 30, 32 and 33 under 35 U.S.C. § 103 over Takizawa in view of Phan and Hayasaki.

OPINION

We reverse the rejections of claims 1, 3, 11, 14, 17 and 19 under 35 U.S.C. § 102(e) over Takizawa, claims 6-8 under 35 U.S.C. § 103 over Takizawa in view of Ogata, claims 12, 13, 15 and 16 under 35 U.S.C. § 103 over Takizawa in view of Hayasaki, and claim 22 under 35 U.S.C. § 103

over Takizawa in view of Phan and Maemori, and affirm the rejections of claims 2, 4, 5, 9, 10, 18, 20, 21, 23-25, 28, 31, 34 and 35 under 35 U.S.C. § 103 over Takizawa in view of Phan, claims 26 and 27 under 35 U.S.C. § 103 over Takizawa in view of Phan and Ogata, and claims 29, 30, 32 and 33 under 35 U.S.C. § 103 over Takizawa in view of Phan and Hayasaki.

Rejection of claims 1, 3, 11, 14, 17, and 19
under 35 U.S.C. § 102(e) over Takizawa

We need to address only claim 1, which is the sole independent claim among claims 1, 3, 11, 14, 17 and 19. Claim 1 requires “displacing the surfactant-containing liquid film with a developing solution of selected concentration”.

“Anticipation requires that every limitation of the claim in issue be disclosed, either expressly or under principles of inherency, in a single prior art reference.” *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1255-56 (Fed. Cir. 1989).

Takizawa discloses a method for developing a photoresist wherein, either before or after exposure, and before development, the photoresist is spin coated at 2,000 to 4,000 rpm with an aqueous surfactant solution to form a monomolecular or polymolecular surfactant film on the surface of the photoresist such that the surfactant’s hydrophobic groups attach to the surface of the photoresist and the surfactant’s hydrophilic groups render the photoresist surface hydrophilic (col. 6, ll. 32-50; col. 8, ll. 2-8, 21-28).

The Appellant argues that when Takizawa’s “solution is applied, the surfactant bonds to the surface to form a surfactant layer while the solvent leaves the surface due to the high rotational speed, and then a developing

solution is applied onto the surfactant layer with no displacement of the surfactant” (Br. 6).

The Examiner argues that Takizawa, “in col[.] 8, lines 30-45, discloses that a developing solution is applied onto the surfactant solution formed on the resist film and that reattachment of the developing solvent is moderated on the resist film[,] i.e., the surfactant solution is displaced with the developing solvent that was applied” (Ans. 15-16). The Examiner also relies, in support of that argument, upon Takizawa’s column 6, lines 37-55 and column 7, lines 8-10.

Those portions of Takizawa do not disclose that a developing solution is applied onto a surfactant solution. What is disclosed is that the surfactant’s hydrophilic groups prevent attachment of the developing solvent to the photoresist surface, thereby decreasing development defects (see also col. 7, ll. 38-41). Takizawa’s disclosure that the surfactant solution is spun onto the photoresist surface at high speed to form a film or coating having hydrophilic groups attached to hydrophobic groups that are attached to the photoresist film (col. 6, ll. 32-50; col. 7, ll. 12-15, 61-63; col. 8, ll. 18-28; col. 12, ll. 1-3, 9-11) indicates that the developing solution is applied not to a surfactant-containing liquid film as required by the Appellant’s claim 1, but, rather, to a surfactant film or coating residue that is left after the liquid from the surfactant solution has been removed by the high speed spinning. Takizawa does not disclose that the surfactant film or coating is a liquid film, and the Examiner has not provided evidence that the surfactant film or coating inherently is in the form of a liquid film.

For the above reasons we find that the Examiner has not established a prima facie case of anticipation by Takizawa of the inventions claimed in the Appellant's claim 1 and its dependent claims 3, 11, 14, 17 and 19.

Rejection of claims 2, 4, 5, 9, 10, 18, 20, 21,
23-25, 28, 31, 34 and 35 under 35 U.S.C. § 103
over Takizawa in view of Phan

Phan contacts an exposed photoresist with an aqueous resist activating solution containing about 0.1 to about 5 wt% surfactant, and then develops the photoresist (col. 2, ll. 22-25; col. 3, ll. 30-31). "The resist activating solution functions to promote at least one of: reduce the surface tension of the aqueous developer, wet the surface of the resist, chemically modifies [sic] the surface of the resist, and prevent formation and/or adherence of microbubbles during development" (col. 3, ll. 30-36). "The resist activating solution contains enough surfactant to wet the surface of the resist and/or to lower the surface tension of water by at least about 5%" (col. 3, ll. 47-49). "The resist activating solution is preferably contacted with the resist immediately prior to development" (col. 5, ll. 12-13). "Alternatively, contact between the resist and the resist activating solution may occur simultaneously with development" (col. 5, ll. 18-20). "The resist activating solution leaves a small amount of a residue on the resist surface" (col. 5, ll. 31-32). Use of the resist activating solution reduces the required amount of developer solution (col. 5, l. 61 – col. 6, l. 7).

The Appellant argues that "Phan et al. do not teach or suggest the claimed displacement" (Br. 8).

Phan's contact of the resist activating solution with developer immediately after the resist activating solution is applied to the photoresist is the same contact used by the Appellant (Spec. ¶ 0067) and, therefore, has the same effect, i.e., to displace at least some of the surfactant-containing liquid film. The use of that contact in Takizawa's method would have been prima facie obvious to one of ordinary skill in the art to obtain the benefits disclosed by Phan of reducing the surface tension of the aqueous developer, wetting the surface of the resist, chemically modifying the surface of the resist, and preventing formation and/or adherence of microbubbles during development (col. 4, l. 64 – col. 5, l. 3). Phan's teaching that the resist activating solution leaves a small amount of a residue on the resist surface (col. 5, ll. 31-32) indicates that hydrophilic groups desired by Takizawa (col. 6, ll. 46-50) would be present on the photoresist surface.

The Appellant argues that Takizawa is silent as to the surfactant solution concentration and does not teach that surfactant concentration is a problem in need of a solution (Br. 8). Takizawa, the Appellant argues, is limited to controlling defects. *See id.*

That argument is not well taken because the Appellant is attacking Takizawa individually when the rejection is based on a combination of references. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981); *In re Young*, 403 F.2d 754, 757-58 (CCPA 1968). Phan would have led one of ordinary skill in the art, through no more than ordinary creativity, to select a surfactant concentration that provides the desired degree of benefit disclosed by Phan, i.e., reducing the surface tension of the aqueous developer, wetting the surface of the resist, chemically modifying the surface of the resist,

preventing formation and/or adherence of microbubbles during development, and reducing the amount of developer (col. 4, l. 64 – col. 5, l. 3; col. 5, l. 61 – col. 6, l. 7). *See KSR Int’l. Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (In making an obviousness determination one “can take account of the inferences and creative steps that a person of ordinary skill in the art would employ”).

The Appellant argues that Phan does not disclose selecting a surfactant concentration based upon one or more characteristics of the photoresist film (Br. 8).

Phan discloses selecting a surfactant concentration high enough to wet the photoresist surface (col. 3, ll. 47-48; col. 5, ll. 41-45). The photoresist film’s wettability is a characteristic of the photoresist film.

For the above reasons we are not persuaded of reversible error in the rejection of claims 2, 4, 5, 9, 10 and 18.

The Appellant relies, with respect to claims 20, 21, 23-25, 28, 31, 34 and 35, upon the arguments discussed above regarding the rejection of claims 2, 4, 5, 9, 10, and 18 (Br. 9). For the reasons given above with respect to claims 2, 4, 5, 9, 10, and 18, we are not persuaded by those arguments. Hence, we are not convinced of reversible error in the rejection of claims 20, 21, 23-25, 28, 31, 34 and 35.

Rejections under 35 U.S.C. § 103 of claims 6-8 over
Takizawa in view of Ogata, and claims 12, 13, 15
and 16 over Takizawa in view of Hayasaki

The Examiner does not rely upon Ogata or Hayasaki for any disclosure that remedies the above-discussed deficiency in Takizawa as to claim 1 from which claims 6-8, 12, 13, 15 and 16 directly or indirectly

depend (Ans. 6-9). Hence, we conclude that the Examiner has not established a prima facie case of obviousness of the inventions claimed in the Appellant's claims 6-8, 12, 13, 15 and 16.

Rejection of claim 22 under 35 U.S.C. § 103 over
Takizawa in view of Phan and Maemori

Claim 22 requires “determining a concentration for the surfactant-containing liquid based on the resist film thickness.”

Maemori discloses a photoresist composition which should be applied in a thickness of 100 to 650 nm and which must contain no more than 50 ppm of surfactant, based on the amount of a resinous compound component (¶¶ 0039, 0042). “This requirement can be accomplished by formulating the composition with a surface active agent in an amount as small as possible or by removing the surface active agent as completely as possible prior to application of the composition onto the substrate surface by using an adsorbent” (¶ 0039).

The Examiner argues that “it would be obvious to a skilled artisan to modify Takizawa in view of Phan by determining surfactant concentration based on the resist thickness as suggested by Maemori because Maemori in [0042], discloses that doing so ensures good uniformity of the coating layer formed on the substrate surface and reduces considerably the defects in the finely patterned resist after development” (Ans. 12).

That portion of Maemori discloses that “[g]ood uniformity of the coating layer formed on the surface of a substrate can be ensured and the number of defects in the finely patterned resist layer after development can be greatly decreased when the thickness is so small as above [100 to 650 nm] even if the concentration of a surface active agent in the

composition is so low as not to exceed 50 ppm by weight” (§ 0042). That disclosure does not pertain to the concentration of a surfactant-containing liquid applied to a photoresist but, rather, pertains to the desired low surfactant concentration in a photoresist composition. The Examiner, therefore, has not established a prima facie case of obviousness of the invention claimed in the Appellant’s claim 22.

Rejections under 35 U.S.C. § 103 of claims 26 and 27
over Takizawa in view of Phan and Ogata, and
claims 29, 30, 32 and 33 over Takizawa
in view of Phan and Hayasaki

The Appellant does not provide a substantive argument as to the separate patentability of claims 26 and 27 over Takizawa in view of Phan and Ogata, and claims 29, 30, 32 and 33 over Takizawa in view of Phan and Hayasaki (Br. 10-11). We therefore are not persuaded of reversible error in the rejections of those claims.

DECISION

The rejection of claims 1, 3, 11, 14, 17 and 19 under 35 U.S.C. § 102(e) over Takizawa is reversed. The rejection of claims 2, 4, 5, 9, 10, 18, 20, 21, 23-25, 28, 31, 34 and 35 under 35 U.S.C. § 103 over Takizawa in view of Phan is affirmed. The rejections under 35 U.S.C. § 103 of claims 6-8 over Takizawa in view of Ogata, and claims 12, 13, 15 and 16 over Takizawa in view of Hayasaki are reversed. The rejection of claim 22 under 35 U.S.C. § 103 over Takizawa in view of Phan and Maemori is reversed. The rejections under 35 U.S.C. § 103 of claims 26 and 27 over Takizawa in view of Phan and Ogata, and claims 29, 30, 32 and 33 under 35 U.S.C. § 103 over Takizawa in view of Phan and Hayasaki are affirmed.

Appeal 2008-3578
Application 10/675,419

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED-IN-PART

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sld

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